

THE WATER SUPPLY

—OR THE—

CITY OF WINNIPEG.

WINNIPEG, APRIL 8, 1887.

The Chairman and Committee on Fire, Water and Light:

GENTLEMEN,

I have the honor to submit herewith a report, prepared in accordance with your instructions of the 16th March last, on the proposals of the 14th March made to the City Council of Winnipeg by the President and Directors of the Winnipeg Water Works Company.

I remain, your obedient servant,

H. N. RUTTAN,
City Engineer.

Report on the proposals for extensions of works, etc., made by the President of the Winnipeg Water Works Company to the City Council, dated 14th March, 1887.

The President begins by stating the position taken by the Company in reference to the artesian wells, sunk by the city, for supplying water for domestic use and sewer flushing. He claims that in sinking wells the city is infringing upon the monopoly granted the Company by its charter.

This point rests upon the legal interpretation of the charter, and whether the artesian wells are pipes for supplying water in the sense referred to in it.

The President then goes on to say:—

The Directors also hold that the extent to which they can be compulsorily required to "provide water is that fixed by the charter, viz : An average calculated per head per diem "at 25 gallons, and that the compulsory supply is limited further to those streets in which it "is shown that a rental amounting to 10 per cent. on the cost can be obtained.

"Lastly, the Directors contend that the free supply of water for the extinction of fires "is limited to that which the resources and powers of their works, as adapted to the requirements of their customers, subject to the statutory provisions above noted, will afford ; and "that no obligation is imposed upon them by the charter to lay larger mains or provide additional pumping power, or higher pressure, than their commercial business of supplying "water for domestic and manufacturing purposes, may, in their judgment require. The "Directors do not desire to enter into any controversy upon these contentions at present ; "they will be prepared to support them when necessity arises ; but in the meantime they "merely state them as the stand point from which the Directors start in the proposals now "about to be submitted."

As the points above referred to were fully answered in the report of the undersigned dated 12th November, 1886, it is not considered necessary to again refer to them, as the

contentions of the city are, however, directly opposed to those of the Winnipeg Water Works Company, on the matters in question it would appear that before any mutually satisfactory arrangement, as to the future, can be arrived at the city and the Company should agree as to what their respective obligations, at present, are. If a mutual understanding cannot be reached, the matter should be decided by arbitration, or otherwise as may be considered desirable.

As the proposals of the Company, for the carrying out of which they ask compensation, include much that is claimed as a right by the city, it is not, until an understanding as above is arrived at, possible to discuss them with a view to determining the compensation which should be given by the city.

The proposals may, however, be examined with reference to the requirements of the city, and with a view of determining what changes, if any, it would be desirable to make in them.

Before referring in detail to the proposals of the Water Works Company, the minimum service which would be acceptable to the city should be decided upon.

QUANTITY OF WATER.

In a former report it was recommended that 800 cubic feet per minute should be provided for by the time the city reached a population of 40,000, and that, in the meantime, the distribution system should be arranged to meet the requirement of that supply, and that the quantity should be maintained as nearly as possible in the above ratio to population. It is considered, therefore,—

1st. That in the extension of the distribution system, as laid down in Plan "D" of the Company's proposals, the quantity of water for present fire purposes should be not less than 200 cubic feet, and for maximum domestic draught, calculated on the basis of 11,000 consumers at 90 gallons, of 100 cubic feet per minute.

2nd. That future extensions should be so arranged that, at the time the population has reached 40,000, the fire supply should be 400 cubic feet per minute, in excess of the domestic draught provided for at the rate of a maximum of 90 gallons per head.

PRESSURE.

Whether a low or high pressure service should be adopted must be decided. A low pressure service would mean from 10 to 40 pounds per square inch at the hydrant, which would not be sufficient for direct use in extinguishing fires. For instance, with 500 feet of hose and one inch smooth nozzle, 42 pounds pressure at the hydrant would deliver only 110 gallons per minute, instead of 150, the standard adopted, and to deliver 150 gallons would require a pressure of 77 pounds, instead of 35 or 40, as proposed by the Company. The low pressure service would necessitate keeping up and increasing the number of steam fire-engines. One of the greatest benefits to be derived by the city from an efficient water works system should be a very large reduction in the cost and increase in the efficiency of the fire department. By referring to tables "A" and "B" in appendix, it will be seen that many cities of much larger population than Winnipeg have only one or two steam fire engines and some of them have none. No. 33, Montreal, population 185,500, has four steamers; No. 23, Ottawa, population about 40,000, has one; No. 15, London, 25,000, has none, and No. 41, Hamilton, has one; No. 34, Atlanta, has three steamers, but *none* of them are used within the limits of the fire hydrants.

It is considered that, for present purposes, the water works should deliver the quantity of water above stated (200 cubic feet above the maximum domestic draught) at Logan street, on Main, at a pressure of 65 pounds per square inch. Even with this pressure at the point named, that portion of the city north of Logan street, with the exception of a short distance

on each side of Main street, would be practically without protection from the water works till the mains in the western portion of the city (which are not included in the works to be immediately executed) are laid.

HYDRANTS.

All hydrants on the smaller mains should be as nearly as possible of the full capacity of the mains. It is understood that the company do not propose laying any mains smaller than 4-inch, which, 4-inch mains will be fed from both ends, so that no hydrant should be of less capacity than two hose streams of 20 cubic feet per minute each. In addition to two hose nozzles each hydrant should be provided with a steamer nozzle for use in case of insufficient pressure caused by a break or otherwise, and for fires at long distances from the hydrants.

It is considered that the water works to be constructed should fulfil the following requirements :—

Quantity of water to be provided in the immediate future, maximum domestic draught, cubic feet per minute	100
Fire supply, cubic feet per minute.	200
Total capacity per minute	<u>300</u>

Fire pressure, to deliver 200 cubic feet per minute at corner of Main and Logan streets at per square inch, 65 lbs. No mains to be less than four inches in diameter; all four-inch mains to be in short lengths and fed from both ends.

Hydrants to be of approved pattern, to be provided with not less than two hose and one steamer nozzle each. Hydrants to be an average distance apart of 500 feet. The fire supply, 200 cubic feet per minute at 65 lbs. pressure, to be drawn from any number of hydrants not more than five at any point on the distribution system.

Adopting the above as the basis of a specification upon which the works for the City of Winnipeg should be constructed, the proposals of the Water Works Company may now be considered.

1st. (a.) "To put up a new engine and pumps to lift 500,000 gallons against a pressure of 75 lbs., and to add a second of the same capacity as soon as the consumption reaches 1,000,000 gallons."

The new pump proposed to be provided would deliver 50 cubic feet per minute, and with the existing pumps would give a total quantity of 150 cubic feet per minute at a pressure of 75 pounds at the pumps. It will be seen that this is only one-half the quantity considered necessary. The pressure is referred to hereafter.

2nd. (b.) "To erect filtering apparatus to filter 500,000 gallons per day, and to increase the same as consumption required it."

This would be satisfactory.

3rd. (c.) "To lay down 13 miles of additional mains as per plans attached to Mr. Elwes' report, of which 7 miles at least to be laid this summer."

The above proposal is considered satisfactory, provided that the mains are of such dimensions that the requirement of the supply as stated in the specification above are fully met.

For instance, if instead of laying the "10" and "8" Mains on Portage avenue and Main street, as is proposed by the Company, plan "D," the present "12" main be continued to the corner of Portage avenue and Main street, and a "10" main laid on the west side of

Main street to Logan street The required quantity 200 cubic feet fire supply (100 cubic feet Domestic draught being drawn off between the pump and Logan street) could be delivered at Logan street with a loss of pressure, due to friction, of about 40 pounds. The pressure at the pump would require to be, therefore, making a slight allowance for angles and valves, approximately 110 pounds instead of 75 pounds By increasing the size of the mains, the initial pressure, to give the same result, would be reduced.

The increase suggested in the size of the mains would not add to the cost of the distribution system when completed as proposed by the Company, but the outlay at present would, of course, be larger.

4th. (d.) "To provide Matthews' post hydrants with frost case, furnished with 5 inch "inlet and two hose nozzles, and drip connection where sewers exist, 500 feet apart in all "streets where mains are laid, except where there are no houses."

The Matthews hydrant is considered one of the best. Some of the hydrants, say 25 per cent., should be of larger size than 5 inch, and all should be provided with steamer nozzles. The hydrants should be located by the city, and some of them in the business centre should be at less distances apart than 500 feet, while others in the suburbs might be further apart, making the average about 500 feet. It might be advisable at important street intersections where there are large mains, to have a few large flush hydrants.

5th. (e.) "To provide a pressure of 75 pounds at the pump house in case of fire, so soon "as the new engine and pumps have been erected, and the present engine and pumps adapted "to that pressure, and meantime to provide a pressure of 50 pounds at the pump house "when required."

As stated under paragraph "C" above, the fire pressure at the pumps, under the conditions there given, should be 110 pounds.

6th. (f.) "To reduce the tariff for domestic supply to the rates in the annexed schedule."

In connection with this proposition, the following tables are submitted, showing comparative statements of rates at other places at the present time. Tables "C" and "D"** give the rates charged by Public and Company Water Works respectively Table "E," which will be found the most convenient for comparisons, gives the prices charged for domestic water supply, including house supply and one each of water closet, bath and wash basin. Owing to the great diversity of systems upon which the rates for the several cities are based, it has not been easy to arrange them in a form in which they could be compared, and while some of the rates given in the tables may not be quite accurate, they are sufficiently so for the purpose for which the tables are intended, viz., to give a fair general idea of the water rates in the various places referred to.

*NOTE.—"C" and "D" have not been published.

The rates in all the places are based upon the water being laid into the premises for which the charge is made There are a large number of houses in Winnipeg without cellars and so lightly built that it would be impossible to protect ordinary water pipes in them from frost, during the coldest weather. To meet the cases of such houses, a few hydrants in neighborhoods where required, might be fitted with faucets and so protected that they would not freeze, from which water might be drawn, as it is at present from the public wells. A much smaller charge might be made to houses taking water in that way than for those into which the water is laid.

In agreeing upon a water rate for Winnipeg, whether the works were owned by a company as at present, or by the city, a margin in excess of those of other places should be allowed, sufficient to cover the extra cost of mains, fuel and labor. Though the rates now proposed by the Company are much lower than the charter rates, a comparison with the rates of other places indicates, even making the allowances above referred to, that there is still room for reduction See table "E."

7th (g.) "To carry out all future extensions upon the general plan 'B.' attached to "Mr Elwes' report, and to continue extending and developing the system as fast as the "revenue obtained will justify the expenditure of fresh capital."

The general plan of the distribution system is considered a good one; it has not been examined in detail, but it is thought that with the slight alterations in leading mains before referred to, the required fire protection can be obtained.

The Council are asked in return for the carrying out of the above proposals :—

1st. (a.) "To refrain from infringing upon the exclusive privileges of the Company by "supplying water gratis in districts served by them or otherwise."

If the city is illegally infringing upon the rights of the Winnipeg Water Works Company, and no new arrangement is entered into, the infringement will have to be stopped. On the other hand the Company is seeking a new arrangement, and it is thought that the city should reserve the right to sink wells. The impression is that the wells have contributed, in no small degree, to the healthiness of the city.

2nd. (b.) "To impose a frontage tax, for fire protection, of ten cents per foot on occupied lots and five cents per foot on vacant lots."

Without admitting that the Company in the above proposals have offered the city anything, which they are not obliged by the charter to carry out, it may be well to consider the best means of compensating them for an efficient service in case it may be necessary to do so.

The frontage tax system is in operation in the following places where the works are owned by the corporations, and it appears to work satisfactorily. In St Paul, Minn., the tax is levied under the following section :—

SEC. 26. "In addition to all the other powers conferred upon the said Board, they are "authorized to and shall assess upon each and every lot in the city of St. Paul, in front of "which water pipes are laid, an annual tax or assessment of ten (10) cents per lineal foot of "frontage of such lot or lots, and which shall be a lien upon such lot or lots, and shall be "collected as hereinafter provided."

In Hamilton, Ontario, the water rate is levied upon the assessed value of the property as follows :—

"Water rates or rents shall be paid upon all vacant lots, and on all houses, stores, offices, buildings, or parts of buildings, which may be let, held or occupied as separate tenements, assessed on the last revised assessment rolls of the city, or specially by the city assessors for water works purposes, as follows" :—

"Property valued at \$500 or under, per annum \$4 50

Here follows a schedule in which lots valued at

\$1000 are assessed for.....	\$ 7 80
1500 " "	10 20
2000 " "	12 60
3000 " "	17 40

"That all buildings and vacant lots valued at \$625 and under upon the above schedule of rates, not having the water introduced, shall be specially noted by the assessors in their returns to the water works office, and the following rates shall be charged in the place of those given above" :—

Property valued at

\$500 or under per annum.....	\$3 40
500 to \$640 "	3 50
540 to \$680 "	3 60
680 to \$25 "	3 75

Then follows the tariff of extra and miscellaneous rates.

The frontage tax proposed by the Company would yield a revenue of from \$12,000 to \$15,000 per annum on the 20 miles of pipes now proposed to be laid.

No case is known where a Company is paid for water service by a frontage tax. By referring to table "B" and appendix "F" it will be seen that the general mode of payment is by hydrant rental, the prices paid ranging from \$25 upwards, per annum, for each hydrant. The usual price, where there are a large number of hydrants, being about \$50. It is thought that this would be the most satisfactory mode of payment.

If the Company is paid directly or otherwise for water for public purposes, the water paid for should include that for sewer flushing, street sprinkling, &c.

3rd. (c.) "To make the use of water compulsory on street upon which mains are laid."

Though the "frontage tax" and "compulsory water rates" are both in common use, in no place known are they in force together.

In Ottawa there is a compulsory rate for houses and a special rate or tax on vacant lots.

The proposals for "frontage tax" and "compulsory rate," if carried out, would have to be modified in some respects.

For instance a vacant, 7 roomed house would pay,

50 ft. lot at 10c. per ft.....	\$ 5 00
Water rate.	20 00
Total.....	\$25 00

Certainly a very large sum for a vacant house when no water was being used.

APPENDIX "G"

contains the answers of City Engineers and Managers of Public Water Works to the question,

"Is it considered best for the water works to be owned and operated by a company or by the "city?"

The almost unanimous opinion is expressed that the works should, in the public interest, be owned and operated by the city, or under its control.

APPENDIX "H"

contains the replies to the above question of City Engineers and Managers of Private Company Water Works.

The opinions, though not so unanimous as these from Public Works, are still in the same direction.

The greatest objection urged against water works being owned by the city, is that they are liable to be mismanaged, or the management to be affected by politics. This cannot be

admitted as a valid objection to the principle that the works should be owned by the city. Cases where mismanagement occurs through political influence are exceptional, the general experience is quite in the other direction.

City water works, as a rule, are not hampered by want of the necessary money to design and construct them in an efficient and economical manner, while works constructed by private companies are too often cut down far below efficiency with the object of saving a small amount of capital or deriving a quick return from the investment.

Works improperly constructed in the first place are generally too expensive to take up and renew, and the consequence is that they remain a drag on economy in operation, and a continual source of annoyance to the community afflicted by their possession.

RELATION BETWEEN WATER WORKS AND SEWERS.

The construction of water works and sewers should be made as far as possible together, and while neither system can be efficient without the other, the fact of a street being without sewers is no reason why the residents should be debarred from using the water works to as great an extent as is possible.

SOURCE OF SUPPLY.

As far as known at present the following are the sources from which water may be obtained for city use, placed in the order of the cost of conducting the water to the city:—

	Probable cost.
1. Assiniboine River .....	.....
2. Artesian Wells (ordinary) .....	.....
3. " (deep) .....	.....
4. Brokenhead River (open cut)	\$ 900,000
" 30 inch main	1,600,000
5. Lake Manitoba (open cut)	1,300,000
" 30 inch main	2,500,000

ASSINIBOINE RIVER.

The objections to the Assiniboine water are, its hardness and at certain seasons of the year the large quantity of clay which it contains. The latter can be readily removed by filtration, and it is probable that the hardness can be considerably reduced during filtration. It is not probable that at present the water is contaminated to any appreciable extent by organic matter. Occasional analysis of the water should be made in order that any dangerous properties may be detected.

ORDINARY ARTESIAN WELLS.

The term ordinary artesian wells is applied to wells such as those now in use, which obtain their supply of water from the drift formation which underlies the impervious clays at a depth of about 75 feet below the surface. The water from this source is good both in appearance and taste. It is, however, harder than the Assiniboine water, and, from some analyses recently made, it appears that it contains such large quantities of minerals, chiefly sulphates of lime and magnesia, as to constitute it practically a mineral water. It is recommended that analyses of the wells and the Assiniboine be obtained before deciding for or against either of the above sources of supply.

DEEP ARTESIAN WELLS.

No deep artesian wells have been tried in the vicinity of Winnipeg. If upon further examination of the water from the Assiniboine and ordinary artesian wells, it is found that

they are both likely to be injurious to health, a deep test well could be sunk at a cost of about \$5,000. A well 1037 feet in depth was sunk at Rosenfeld Station, about 50 miles south of Winnipeg, from which no sufficient supply of fresh water was obtained, but instead a very large flow of brine.

In addition to what may be termed the local sources of supply, rough estimates have been given of the cost of conducting water into the city from the Brokenhead River and Lake Manitoba. The Brokenhead water is known to be good, and if not sufficient in quantity could be supplemented by the Whitemouth River, the headwaters of which are a short distance east of it. The Lake Manitoba water, it is feared, would be alkaline, and in any case it would be more expensive than the Brokenhead supply.

Every hope is entertained that a satisfactory supply can be obtained from local sources, and the others are referred to only to show what could be done in case of necessity.

The question of the source of supply is one which should be very carefully examined before any decision is arrived at. The construction of the works and the discussion of other matters affecting them need not in the meantime be delayed.

For answers to questions in appendixes G. and H., and for the information from which the tables are compiled the undersigned is indebted to the City Engineers and Managers of Water Works of the several places referred to. The information concerning "Mode of Supply," and size of pipes, has been completed from J. J. R. Croes' Statistical Tables.

H. N. RUTTAN,
M. C. Soc. C. E.
City Engineer.

NOTE.—For convenience, and uniformity with Mr. Elwes' Report, one cubic foot of water per minute has been taken as equal to 10,000 gallons per day.

APPENDIX "F."

Question.—If Works are owned by a Company, how is water for extinguishing fires, sewer flushing, &c., paid for?

RACINE, WIS.

ANSWERS.—By hydrant rental. Water free for all city uses, for schools and churches, and drinking basins for animals in each ward, 7 wards. Water is free also for flushing sewers and city construction work. Thirty hydrants at \$45, annually.

UTICA, N. Y.

City pays about \$17,000 per annum.

KANSAS CITY, MO.

By annual rent of fire hydrants.

SCRANTON, PA.

By appropriation of councils.

AKRON, OHIO.

Forty-five dollars per hydrant up to 200; above 200, \$40 per hydrant. Water free for all other city work.

DAVENPORT, IA.

Hydrants \$50 each ; number of hydrants, 253 ; flushing, &c., 15c. per 1,000 gallons.

MONTGOMERY, ALA.

By the city ; \$11,000 per year for 200 hydrants.

CHARLESTON, S. C.

By a sum of \$10,000, paid as per contract enclosed.

ATCHESON, KAN.

By the city, as per ordinance granting the company the right to construct and operate the works.

WILLIAMSPORT, PA.

The city have special rates, and pay \$10 for each fire hydrant, and have about 160 in use and are constantly adding.

DUBUQUE, IA.

City pays \$75 per annum for first 100 hydrants, and \$50 per annum for additional ones.

APPENDIX "G."

ANSWERS RECEIVED FROM PUBLIC WATER WORKS.

Question.—Is it considered best for the Works to be owned and operated by the City or by a Company?

LA CROSSE, WIS

ANSWER.—By the city, on account of economy.

SPRINGFIELD, ILL.

By the city, for the reason that the water can be furnished to the people for cost, and further, it is certainly best to have all that is necessary to the health and preservation of the inhabitants in the hands of those who are responsible to the people, the same as the sewerage system and our school system.

HYDE PARK, ILL.

By the city, as the works can be operated at less expense, and as the consumption increases the cost per gallon for delivery will be diminished, the profits go to the corporation or rates can be reduced.

PEORIA, ILL.

By the city. With commissioners, by taking it out of the hands of the city council it would be more satisfactory as it would be independent of politics.

BAY CITY, MICH.

By the city. This opinion is founded on fifteen years' experience, and a somewhat intimate knowledge of the experience of other cities under a different system.

GRAND RAPIDS, MICH.

City. High rates usually charged for public service, hydrants, and generally inefficient construction occasioned by a desire to obtain highest rates or most money possible from smallest outlay.

LA FAYETTE, IND.

It was so considered and the works were constructed by the city and have always been owned by it; the grounds for this opinion is that the works may be controlled and used in the interests of the city. There is this objection that every citizen feels that he is a partner and wants things run to his particular advantage, whereas if owned by a company such one would expect to pay for all he got.

HARTFORD, CONN

We think by city. Because water works when properly managed by city can furnish cheaper water, and are not so liable to conflict with city authorities as private corporation with monopoly.

LAKE, ILL.

This question I will not attempt to answer now, as my experience has always been in towns that owned their own system. Undoubtedly there are advantages in either case. Under the laws of this state all money collected as water rates is used only in said water department.

JACKSON, MICH.

By city. Ground for this opinion over sixteen years experience.

COLUMBUS, OHIO.

Depends entirely on circumstances.

WORCESTER, MASS.

By city. Many reasons, principal one that it is a splendid investment for city. Has proved to be very profitable.

YONKERS, N.Y.

City.

LONDON, ONT.

City undoubtedly. Lower rates, better services, and control both of the quality and regularity of supply. In addition to this, water works when properly managed are a paying investment and the citizens should get the benefit. When run by a company the service is seldom satisfactory.

MANCHESTER, N.H.

Yes and no. If the city owns it keep it out of politics for the reason that when political parties have charge they are making frequent changes, putting poor men where the best should be, and also the city can afford to lay larger pipe and more of it than a private company could. A private company would have the best men for the place and retain them during good behavior or success.

CAMBRIDGE, MASS.

City. The grounds for this opinion are that many differences are likely to arise in regard to management, fire services, etc., etc.

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ARWICH, CONN.

City in my opinion. Services likely to be more satisfactory

CHELSEA, MASS.

By the city. A more equitable rate, greater ease in looking after streets dug up.

WILMINGTON, DEL.

Our system is thought best although the city owns the plant. A Board of Water Commissioners takes its control away from partisanship.

OTTAWA, ONT.

By City. Grounds for this opinion over 25 years' experience.

BINGHAMPTON, N.Y.

This city would not consent under any circumstances to have a company own the works. The works originally cost the city about \$200,000, it has maintained itself from the net earnings, has extended the mains with iron about 15 miles, and relaid 7 miles of cement pipe which was first put in with iron, all from earnings. The work could be sold to a company for more than \$600,000 and has cost the city \$200,000.

WATERBURY, CONN.

By the city. Opinion founded on experience and practice.

EAST SAGINAW, MICH.

By the city. Absolute control and cheaper in the long run. A private company would have no special inducement to lay mains when prospective revenue from private consumers was small and yet when fire protection was urgently needed. We have miles of mains with few water takers but mainly to furnish fire protection. Rates charged by private companies are almost invariably much higher than when the city owns the works.

HAMBURG, PA.

By the city. We think plenty of water should be given the people at low rates, even if no profit to the city accrue. Our works cost \$800,000 and are just about self-sustaining.

HOLYOKE, MASS.

We consider our system better for the public than if the same were owned by a corporation. We get much better rates and the property will pay for itself within a few years. So valuable is it considered that a corporation within a year offered to assume the whole city debt of some \$800,000 for this property and its rights.

SALT LAKE CITY, UTAH.

It is generally considered best by the city; mainly, I suppose, the assurance of a cheap and regular system of rates.

SUMERVILLE, MASS.

City always.

1256 U.S.

ATLANTA GA.

By the city. We are of the opinion that as far as possible all things of the character of water works, sewers, etc., should be managed by the people through a board, and kept clear of political influence. If we were at the mercy of a private corporation we should be paying about 50c. per 1,000 gallons and an immense sum for hydrants and other service of like character. There are many other good reasons.

ALTOONA, PA.

By city. You get cheaper rates and there is no opportunity for oppression on the people by exorbitant charges. It is the best paying department that a city has. By all means a city should own their water works.

SAVANNAH, GA.

By city. On the ground of economy for city uses and general satisfaction.

LYNN, MASS.

By the city, that the city may control them. If they are profitable to a company why not to the city?

TAUNTON, MASS.

By the city. Every waterworks company make money and the city might as well make it or save it as to allow a company to do it.

NEWTON, MASS.

I fully believe that all water works should be built, owned and operated by the city. 1st. There is no reason why works cannot be constructed by or under the city as cheaply as by a private company. Money for the building of the works can ordinarily be obtained by the city from one to three per cent. less interest than a private company. In short, if constructed by city with proper design, works will be constructed better, stock and bonds will not be watered from fifty to one hundred per cent. upon which your people will be taxed to pay interest.

HAMILTON, ONT.

Certainly by the city. On the grounds of common sense.

ST. PAUL, MINN.

By the city.

FALL RIVER, MASS.

City.

SPRINGFIELD, MASS.

By the city. We are of opinion that we obtain our water at a smaller cost than a private company could furnish the same.

PAWTUCKET, R.I.

City. That the city controls its supply and service, also that the works are a source of revenue to the city.

FORT WAYNE, IND.

We think it best for the city to own the works. 1st Because the city can use just what water is wanted for any purpose. 2nd. Because the revenue derived from water rents pays all expenses connected with the system, and we have a surplus of over \$23,000 on hand, and at the same time can protect the citizen from being imposed upon by outside corporations.

LYNCHBURGH, VA.

By city. No special reasons based upon experimental knowledge can be assigned, but the community at large is opposed to water works owned and controlled by a company.

QUEBEC, Q.

By a company. There would be less bad debts if owned by a company.

LEWISTON, ME.

By city. Better control of works, lower rates, and considerable income to city.

APPENDIX "H."

ANSWERS RECEIVED FROM COMPANY WATER WORKS.

Question —Is it considered best for the Works to be owned and operated by the City or by a Company?

RACINE, WIS.

ANSWER.—It is my opinion that private Company gives better service and costs taxpayers less money. It is generally conceded that when city operates works a deficiency bill is put through council every year and the taxpayer pays his water works annually, same as in city when water is supplied by private company. Our water rates are lower than in Chicago or Milwaukee, and these cities get their water from same source and in the same manner, practically. From personal knowledge I know that a city employs two or three salaried men in water works department where private company will employ one to do the same work.

UTICA, N. Y.

By the city. Better works at less cost to the city and private consumers.

KANSAS CITY, MO.

In my opinion the city should own the works. Because in this city we pay an annual rental of \$53,000 as rent of hydrants already let, and with our probable increase we will soon pay about \$65,000. Our present payment is more than the annual interest on the money required to build the work and the ordinary operating expenses, leaving out the profits of the company from private consumption.

SCRANTON, PA.

Cities owning water works properly managed, say they are the source of a considerable income to the city. This can be more fully explained by writing to the city engineer of Reading, Pa., or to other engineers where a city water works are in operation.

AKRON, OHIO.

Conundrum.

MONTGOMERY, Ala.

By company. Better management than by elective city officials.

CHARLESTON, S. C.

Should be owned and entirely controlled by the city. That there can be no effective system in all its bearings and workings. Political rings will control the authorities unless made up of from business men who have but the city's interest to serve, inefficiency in management, indifference to the wants of the community, imperfect service, and self interests, to the detriment of the rights of the people.

ATCHISON, KAN.

There are different opinions on the subject. I incline to the opinion that it is best for all parties that the works be controlled by a company. Waterworks owned and controlled by a city become a nest for *foul political birds*, and if the water should be good the management becomes polluted. I may be prejudiced.

WILLIAMSPORT, PA.

The experience, I believe, wherever tried is in favor of the management of companies, so far as economy. There is sure to have a *ring* formed in the management of the finance of all cities.

DUBUQUE, IA.

Works economically by the Company. The system is simple, being "gravity plan."

APPENDIX "K."

Question.—Has the Company a monopoly of the water supply, and if so, on what conditions?

RACINE, WIS.

ANSWER.—It has twenty-five years contract with city. City can buy upon appraisal at fifteen, twenty or twenty five years. Three hundred hydrants at \$45 = \$13,500 annually. Additional hydrants, \$25 annually.

UTICA, N. Y.

Practically so, as capital will not go in a competing company, and the contract with city for hydrants is perpetual.

KANSAS CITY, MO.

The company have a monopoly for twenty years from 1874.

SCRANTON, PA.

Practically they have. I understand they have purchased the rights of all water supplies for many miles around the city.

AKRON, OHIO.

No monopoly can be granted ; they are the only company now.

DAVENPORT, IA.

Yes.

MONTGOMERY, ALA.

No monopoly.

CHARLESTON, S. C

Artesian well. Very limited service, totally insufficient, as you will see by pressure.

ATCHISON, KAN.

Yes.

WILLIAMSPORT, PA.

The company control the mountain streams available within reach. Our system is by gravity from the streams, 120 feet above the streets of the city, and have about forty-five miles of pipe.

DUBUQUE, IA.

Monopoly. Conditions that ample water be furnished for all purposes.

TABLE "A."

PUBLIC WATER WORKS STATISTICS.

No. of States in U. S.	Name of Place.	Population	Wt. of Supply	Pipes— In.	Sizes— In.	Number Hydrants	Annual Hydrant Expense	Ordinary Fire Exts. lbs.	Heavy Fire Exts. lbs.	Quantity Water ex- pressed min. per fire	No. of S. E. pressur es	Fire Ex- t. pres- sure min.	Years earliest works in Water	Water Compu- ter or Opt.	Opt.
101	143 Racine, Wis.....	19,700	P. S.	32	24-6	300 over	\$ 45 1 25	62	1.5	...	1	2 mo's	1	...	Always use fire engines.
102	57 Utica, N. Y.....	40,000	G.	...	2 -6	...	17,000 53,000	20	60	...	5	40	...	...	Average pressure.
103	33 Kansas City, Mo.....	86,000	P. D.	...	...	...	95,000	10	110	...	3	13	...	...	Pressure varies; steamers seldom used.
104	42 Scranton, Pa.....	25,000	P. R.	...	16-3	253	45 & 40	...	120	...	5	20	...	...	Pressure varies; water for city use free. No monopoly can be granted.
105	139 Akron, O.....	25,000	P. D.	...	14-4	253	50	60	90	...	3	6	...	...	Opt.
106	95 Davenport, Ia.....	25,000	P. D.	...	10-3	200	55	60	125	...	none	13	...	...	Present source of supply inadequate.
107	125 Montgomery, Ala.....	50,000	P. T.	...	16-4	...	10,000	28	35	...	3	1	...	...	Supply said to be "totally insufficient" from artesian wells.
108	39 Charleston, S. C.....	50,000	P. R.	...	12-4	...	40-90	49-90	49-90	...	9	7	...	...	Use fire engines.
109	153 Atchison, Kansas.....	50,000	P. R.	...	16	...	16	10	52	...	1	6	...	...	Opt.
110	117 Williamsport, Pa.....	50,000	G.	...	12-4	...	\$75 1st 100 50 add't	42	42	...	4	21	...	...	Use fire engines.
111	89 Dubuque, Iowa.....	20,000	P. T.	...	12-4	75 30	70 50	25-50	80-100	350	3	16	...	...	Present source of supply inadequate.
112	128 Wilmington, N. C.....	50,000	P. R.	...	16-4	...	50	60	150	...	3	5	...	...	City paid last year \$26,535, contract in 1867, for 20 years.
113	105 San Antonio, Tex.....	50,000	P. D.	...	...	185	...	55	75	...	3	20	Opt.	...	...
114	100 Oswego, N. Y.....	50,000	P. R.	...	...	...	...	...	...	...	8	...	...	...	...

REFERENCES—G., Gravity; P. D., Pump Direct; P. R., to Reservoir; P. S., to Standpipe; P. T., to Tank.

TABLE "A."

PUBLIC WATER WORKS STATISTICS.

No. in Croes' Statistics.	Name of Place.	Population.	Mode of Supply	Pipes Miles.	Pipes Sizes.	No. of Hydrants.	Annual Price per Hydrant.	Pressure.		Quantity of water per min. at Fire Pressure C. Ft.	No. of Steam Fire Engines.	Works in Operation. Years.	Water rates. Compulsory or Optional.
								Ordinary lbs.	Fire lbs.				
1 157	LaCrosse, Wis.	26,800	P. D.	.....	.....	.....	.....	60	100	.....	2	11	Com.
2 109	Springfield, Ill.	30,000	P. R.	15-4	.....	.....	.....	25	40	.....	2	25	Com.
3 147	Hyde Park, Ill.	60,000	P. D.	.....	.....	.....	.....	45	90	.....	2	15	Opt.
4 74	Peoria, Ill.	40,000	P. D.	16-4	.....	.....	.....	90	160	.....	2	20	Com.
5 104	Bay City, Mich.	32,000	P. D.	16-3	.....	.....	.....	40	90	800	2	15	Com.
6 63	Grand Rapids, Mich.	.....	P. R.	20-4	.....	.....	.....	70	70	.....	3	14	Opt.
7 155	LaFayette, Ind.	20,000	P. R.	16	.....	.....	.....	85	100	.....	1	12	Opt.
8 107	Newport, Ky.	26,000	P. R.	30-4	.....	.....	.....	75	90	.....	1	15	Opt.
9 46	Hartford, Conn.	45,000	G. P. R.	24-3	405	.....	.....	65	100	.....	6	27	Opt.
10 120	Lake, Ill.	.....	P. D.	16-3	.....	.....	.....	5	18	.....	4	5	Com.
11 141	Jaekson, Mich.	23,500	P. D.	15-4	.....	.....	.....	60	120	.....	1	17	.....
12 36	Columbus, O.	80,000	P. D.	20-4	.....	.....	.....	60	120	.....	1	16	Opt.
13 31	Worester, Mass.	75,000	G.	21-2	.....	.....	.....	70	150	.....	4	40	.....
14 118	Yonkers, N. Y.	22,000	{ P. R. } { P. D. }	24-4	.....	.....	.....	.....	130	.....	none	10	Opt.
15 101	London, Ont.	25,000	P. R.	12-4	.....	.....	.....	80	80	.....	none	8	Opt.
16 61	Manchester, N. H.	.....	P. R.	20-4	.....	.....	.....	60	60	.....	4	14	Opt.
17 34	Cambridge, Mass.	.....	{ P. S. }	48-3	.....	.....	.....	25	45	.....	5	32	Com.
18 79	Salem, Mass.	28,000	P. R.	20-1	.....	.....	.....	45	45	.....	3	18	Opt.
19 152	Norwich, Conn.	21,143	G.	.....	.....	.....	.....	.....	.....	.....	3	.....	.....
20 49	Lawrence, Mass.	.....	P. R.	18-3	.....	.....	.....	70	70	.....	4	11	.....
21 96	Chelsea, Mass.	27,000	P. R.	16-3	.....	.....	.....	18	40	.....	2	20	.....
22 45	Wilmington, Del.	57,000	P. R.	16-1½	.....	.....	.....	.....	60	.....	6	20	.....
23 80	Ottawa, Can.	.....	P. D.	24-3	.....	.....	.....	80	110	.....	1	10	Com.
24 129	Binghampton, N. Y.	22,000	P. D.	24-2	.....	.....	.....	50	80	.....	2	26	Opt.
25 126	Waterbury, Conn.	30,000	P. G.	20-1	.....	.....	.....	.....	100	.....	2	20	Opt.
26 116	East Saginaw, Mich.	33,000	P. D.	25-1	.....	.....	.....	10	80	.....	none	13	.....
27 66	Harrisburg, Pa.	.....	P. R.	21-16	.....	.....	.....	.....	60	.....	5	47	Opt.
28 77	Eric, Pa.	35,000	P. S.	12-4	.....	.....	.....	.....	70	70	1	11	Com.
29 93	Holyoke, Mass.	35,000	G.	20-4	.....	.....	.....	15-90	15-90	.....	4	13	Opt.
30 102	Salt Lake City, Utah.	.....	G.	27-4	.....	.....	.....	.....	avge	avge	1	15	.....
31 30	Lowell, Mass.	70,000	P. R.	24-4	.....	.....	.....	15-70	15-65	.....	3	20	.....
32 86	Somerville, Mass.	30,000	G.	.....	.....	.....	.....	15-75	same as ordinary	.....	1	20	.....
33 15	Montreal, Q.	183,500	P. R.	.....	.....	.....	.....	80-160	.....	.....	4	30	Com.
34 52	Atlanta, Ga.	.....	P. D.	.....	.....	.....	.....	40	120	.....	3	12	Opt.
35 110	Altoona, Pa.	.....	G.	.....	.....	.....	.....	75	75	.....	3	16	.....
36 69	Savannah, Ga.	43,00	P. T.	24-1	.....	.....	.....	30	30	.....	4	33	.....
37 51	Lynn, Mass.	45,861	P. R.	20-4	527	.....	.....	65	65	500	5	16	Opt.
38 99	Taunton, Mass.	23,674	P. D.	20-4	.....	.....	.....	40	100	150	2	11	.....
39 83	New Bedford Mass.	.....	P. R.	24-4	.....	.....	.....	4-65	.....	5	5	18	Opt.
40 133	Newton, Mass.	.....	P. R.	24-4	.....	.....	.....	30	90	.....	12	12	Opt.
41 54	Hamilton, Ont.	41,000	P. R.	.....	.....	.....	.....	50	.....	.....	1	28	Com.
42 48	St. Paul, Minn.	130,000	G.	24-4	.....	.....	.....	5-1-0	100	.....	8	22	.....
43 40	Fall River, Mass.	60,000	P. S.	24-6	.....	.....	.....	80	80	.....	5	13	Opt.
44 60	Sprinfield, Mass.	38,000	G.	24-1½	.....	.....	.....	80-130	80-130	.....	4	14	.....
45 115	Pawtucket, R. I.	25,000	P. R.	30-4	.....	.....	.....	65-120	100	.....	3	9	.....
46 82	Ft. Wayne, Ind.	32,70	P. D.	24-4	.....	.....	.....	40	100	.....	3	6	.....
47 144	Lynchburg, Va.	22,000	P. R.	18-1½	.....	.....	.....	0-145	0-145	.....	2	59	.....
48 29	Quebec, Q.	65,000	G.	30-4	.....	.....	.....	95-140	95-140	.....	3	10	.....
49 113	Lewiston, Me.	21,500	P. R.	24-4	.....	.....	.....	65-110	65-110	.....	2	9	.....

TABLE "B."

COMPANY WATER WORKS STATISTICS.

No. in Croes' Statistics.	Name of Place.	Population.	Mode of Supply	Pipes Miles.	Pipes Sizes. In.	Number of Hydrants.	Annual Price per Hydrant.	Pressure.		Quantity of water per min. at Fire pressure, c ft	No. of Steam Fire Engines.	Works in operation. Years.	Water rates. Compulsory or Optional.
								Ordinary lbs.	Fire, lbs.				
101 143	Racine, Wis.	19,700	P. S.	32	24-6	300 over	\$ 45	62	1-5	1	2 mo's	Opt.
102 57	Utica, N. Y.	40,000	G.	2-6	17,000	20	60	5	40
103 33	Kansas City, Mo.	P. D.	53,000	110	3	13
104 42	Seranton, Pa.	86,000	G.	35,000	10	120	5	20
105 139	Akron, O.	25,000	P. R.	16-3	.....	45 & 40	.....	90	.....	3	6	Opt.
106 95	Daveuport, Ia.	25,000	P. D.	14-4	253	50	60	125	3	13
107 135	Montgomery, Ata.	P. D.	10-3	200	55	90	91	1	1
108 39	Charlston, S. C.	51,000	P. T.	16-4	.....	10,000	28	35	.....	9	7	Supply said to be "totally insufficient" from artesian wells.
109 153	Atcheson, Kansas.	.....	P. R.	12-4	.....	.....	40-90	49-90	.....	1	6	Opt.
110 117	Williamsport, Pa.	.....	G.	16	16	10	52	.....	.....	4	21	Use fire engines.
111 89	Dubuque, Iowa.	.....	G.	12-4	.....	\$75 1st 100 50 add't	42	42	.....	3	16	Present source of supply inadequate.
112 128	Wilmlington, N. C.	20,000	P. T.	12-4	75 30	50	25-50	80-100	350	3	5	.....
113 105	San Antonio, Tex.	.....	P. D.	16-4	.....	50	60	150	.....	8	.....	City paid last year \$26,535. contract in 1867. for 20 years.
114 100	Oswego, N. Y.	.....	P. R.	.....	185	.....	55	75	.....	3	20	Opt.

REFERENCES—G., Gravity; P. D., Pump Direct; P. R., to Reservoir; P. S., to Standpipe; P. T., to Tank.

-COMP

	Persons.		20.—Lawrence, Mass.				
	Rooms.		42.—St. Paul, Minn.				
	Faucet.		43.—Fall River, Mass.				
12 00	10 50	15 00	16 00	12 50	12 00	14 00	
13 40	10 80	15 00	16 00	12 50	12 50	14 00	
14 80	11 10	15 00	16 00	12 50	13 00	14 00	
16 20	11 40	15 00	16 00	12 50	13 50	14 00	
	11 70	15 00	16 00	12 50			
17 60	12 00	15 00	16 00	12 50	14 00	14 00	
19 00	12 30	15 00	16 00	12 50	14 50	14 00	
20 40	12 60				15 00		
21 80	12 90				15 50		
	13 20				16 00		
	13 50				16 50		
3 00	2 00	5 00	4 00		4 00	3 00	
	1 00	4 00	2 00		2 00		
4 00	3 00	5 00	4 00		3 00	3 00	
Free	2 00	3 00	2 00				
Free	Free	Free	Free	2.50	Free	2 00	
.02 to .01	.04-.01	.03	.03	.03	.05-.01	.01	

qual ugy will be assessed at \$2,000, and that the average

TABLE "E."—PUBLIC WATER WORKS.—COMPARATIVE RATES, INCL

NOTE.—Table "E."—For the purpose of comparison, the several systems upon which water rates are based have been placed in the left-hand column, those which are considered equal upon the same line. For instance, the rental of such a house would be \$160 per annum.

S, INCLUDING BATH AND WATER-CLOSET, ETC.

For instance, it is considered that in a seven roomed house the average number of residents will be seven, that the average house of this capacity will be assessed at \$2,000, and that the average

TABLE "E"—Continued.

COMPANY WATER WORKS.—COMPARATIVE RATES, INCLUDING BATH AND WATER CLOSET AND ONE WASH BASIN.

101.—Racine, Wis.	Faugeset.	Rooms.	Winnipeg, Man.	
102.—Utica, N.Y.				
103.—Kansas City, Mo.		Rooms.		
104.—Scranton, Pa.				
105.—Akron, Ohio.		Rooms.		
106.—Davenport, Iowa.			Rates not published.	
107.—Montgomery, Ala.				
108.—Charleston, S.C.			Motor rates.	
109.—Atchison, Kan.				
110.—Williamspoint, Pa.	Faugeset.			
111.—Dubuque, Iowa.				
112.—Wilmington, N.C.	\$6.00, 1 per 0.60, per Rooms over 5.			

* Rates proposed by Winnipeg Water Works Company—Frontage tax, ten cents per foot extra.